AmeriFlux-RuBisCO working group

Trevor F. Keenan
Assistant Professor, UC Berkeley
Faculty Scientist, Lawrence Berkeley National Lab.

Bill Riley
Senior Scientist,
Lawrence Berkeley National Lab.

AmeriFlux-RuBisCO Working Group

- Formed after community recommendation from the 2016 International Land Model Benchmarking (ILAMB) Workshop Report
- Objective is to derive approaches for using data to inform models

Data to Knowledge

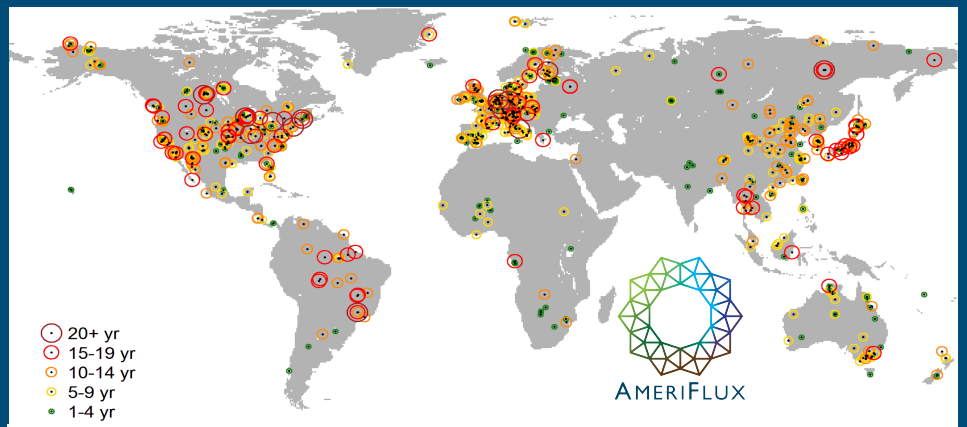
Synthesize existing data from collaborative networks, archives, and publications

Knowledge to Data

Perform simulations to test hypotheses and characterize model structural uncertainties

Predictive Understanding

Design functional relationship metrics to confront models and apply data-driven approaches to model formulation



The global distribution of sites registered with the FLUXNET network-of-networks. Circle sizes and colors represent the length of time a particular site has been in operation.

Global Data Synthesis Theme

- Quantify the functional response of ecosystems to environmental change and responses to controlling mechanisms
- Combine observations from distributed observational networks, such as AmeriFlux, ICOS, TERN, CZO, LTER etc.

Model–Data Integration Theme

- Develop consistent datasets for initializing, forcing, and benchmarking microbially explicit soil carbon models
- Characterize model structural uncertainty through software frameworks to understand controlling mechanisms

For more information, contact Bill Riley <forrest@climatemodeling.org> or Trevor Keenan <trevorkeenan@lbl.gov>

Kick-off meeting, Oct 2019

40 participants (US, Canada, Europe & China)

Working group subgroups:

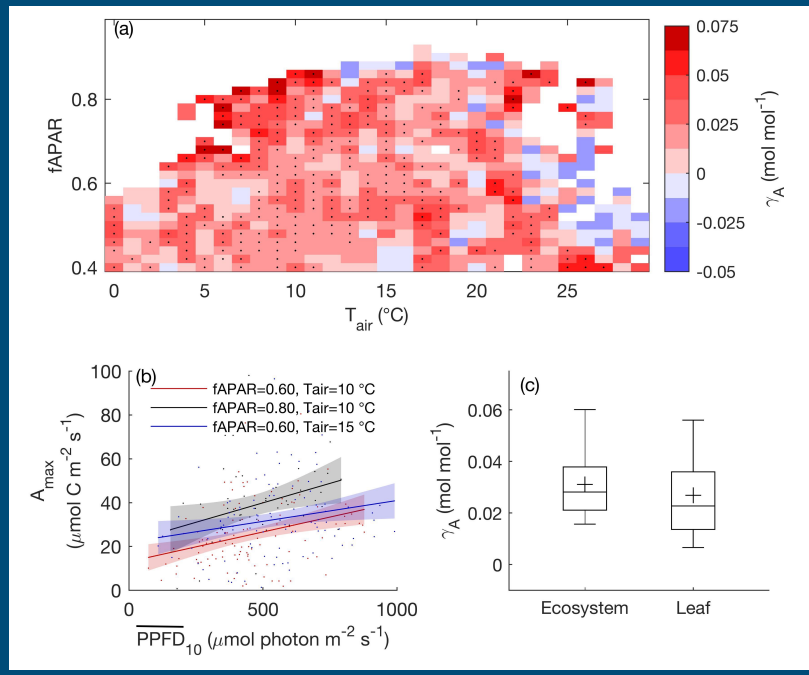
1. Long-term dynamics
2. Responses to extreme events
3. Constraints on net carbon exchange
4. Spatial scaling of ecosystem carbon and water fluxes

1. Long-term dynamics

Can we leverage long-term datasets to better understand ecosystem function?

Global evidence for the acclimation of ecosystem photosynthesis to light

- Global photosynthesis is the largest carbon flux on Earth.
- Multi-scale observations demonstrate the widespread existence of photosynthetic light acclimation
- Results show that current terrestrial biosphere models (TBMs) do not to accurately represent light acclimation



Luo, X. et al. (2020) *Nature Ecology & Evolution*

1. Long-term dynamics

Can we detect trends in photosynthesis, evapotranspiration and water use efficiency?

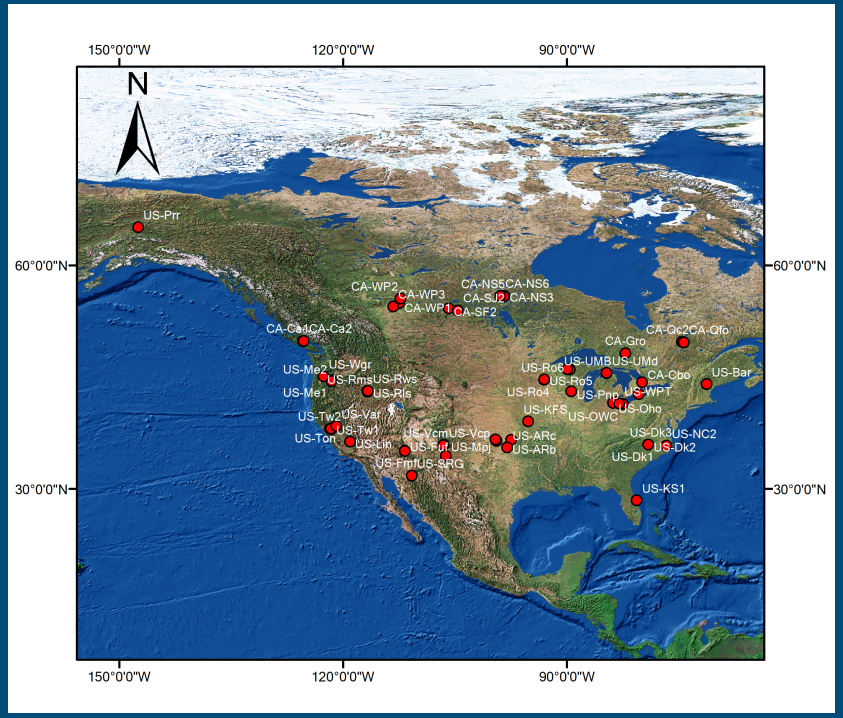
Increasing signal-to-noise:

- more long-term site data

ONEFlux processing of AmeriFlux data (60+ new sites)

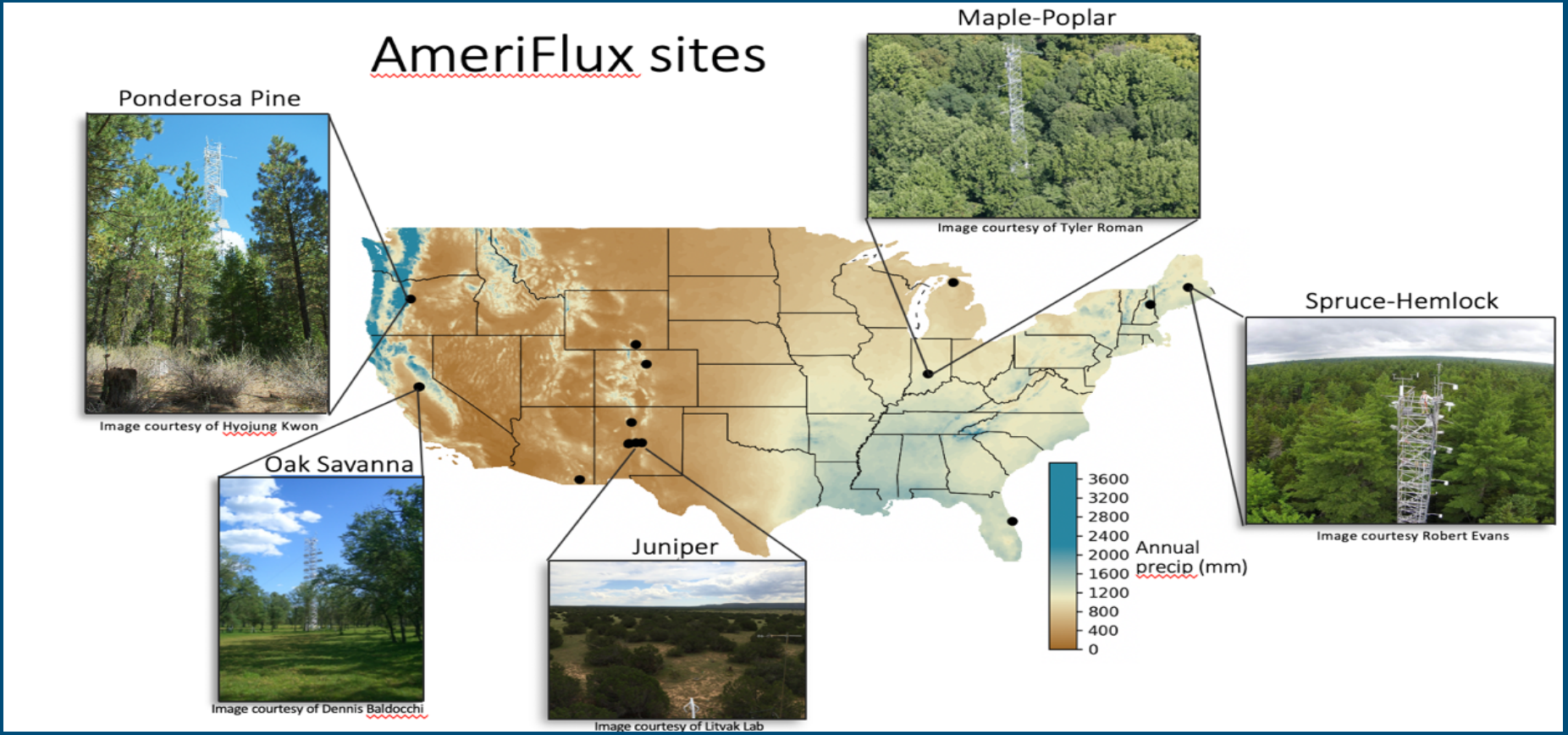
REddyProc processing of AmeriFlux data (250+ new sites)

- applying multi-variate statistical learning to ET and WUE timeseries



Xinchen Lu et al. in prep

2. Responses to extreme events



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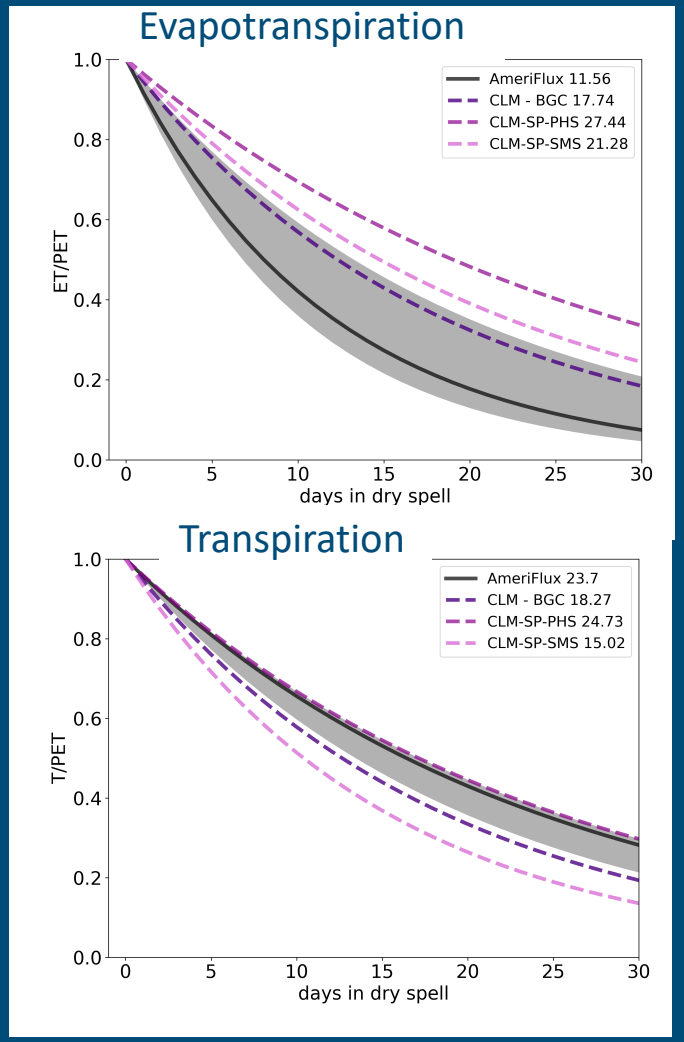


Models underestimate the response of ET

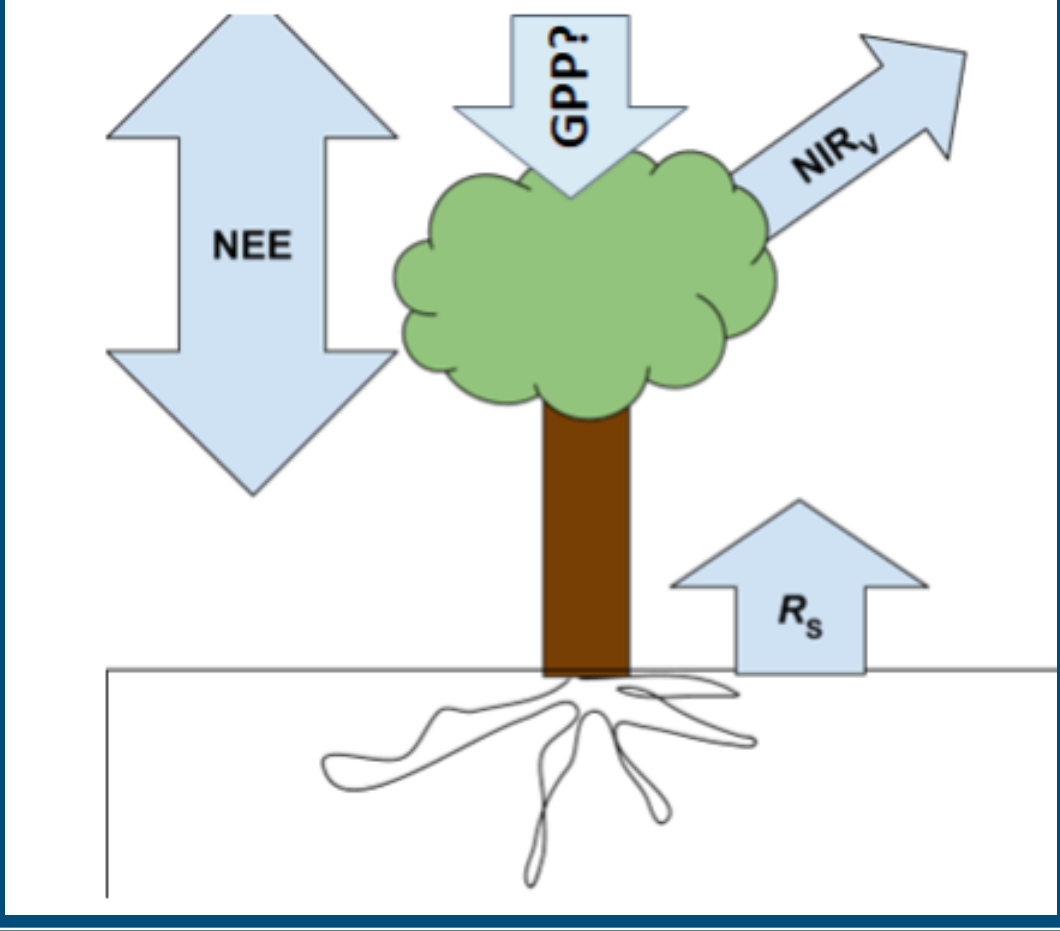
But overestimates the response of T

-> new insight into the response of T/ET to drought

Hawkins et al. (in prep)

3. Constraints on net carbon exchange

“Flux Finality”



- Goal: integrate independent measurements with eddy covariance observations to increase confidence in GPP and Reco estimates by EC towers
- Builds on ideas by Phillips et al. (2017), Wang et al. (2017), and Barba et al. (2018)
- Bond-Lamberty et al. (in prep)

4. Spatial scaling

Nested structure

Semi-continental

Mesoscale

Flux footprint

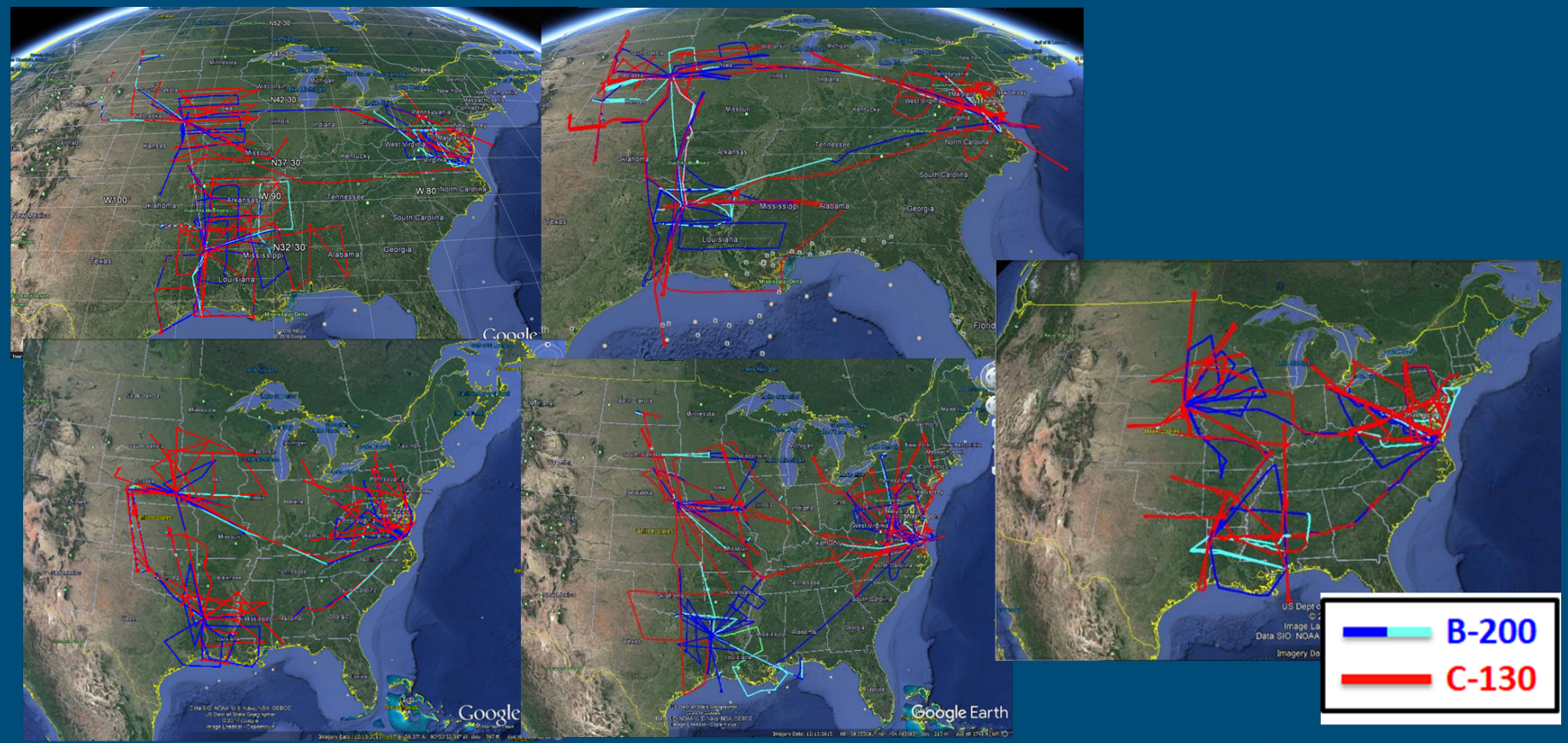
Sub-footprint

Ken Davis, Stefan Metzger, Housen Chu, Hamze Dokoohaki, David Durden, Andrew Fox, Tobias Gerken, Forrest Hoffman, Jitendra Kumar, Sreenath Paleri

4. Spatial scaling

Top-down Constraints

ACT-America flight campaigns

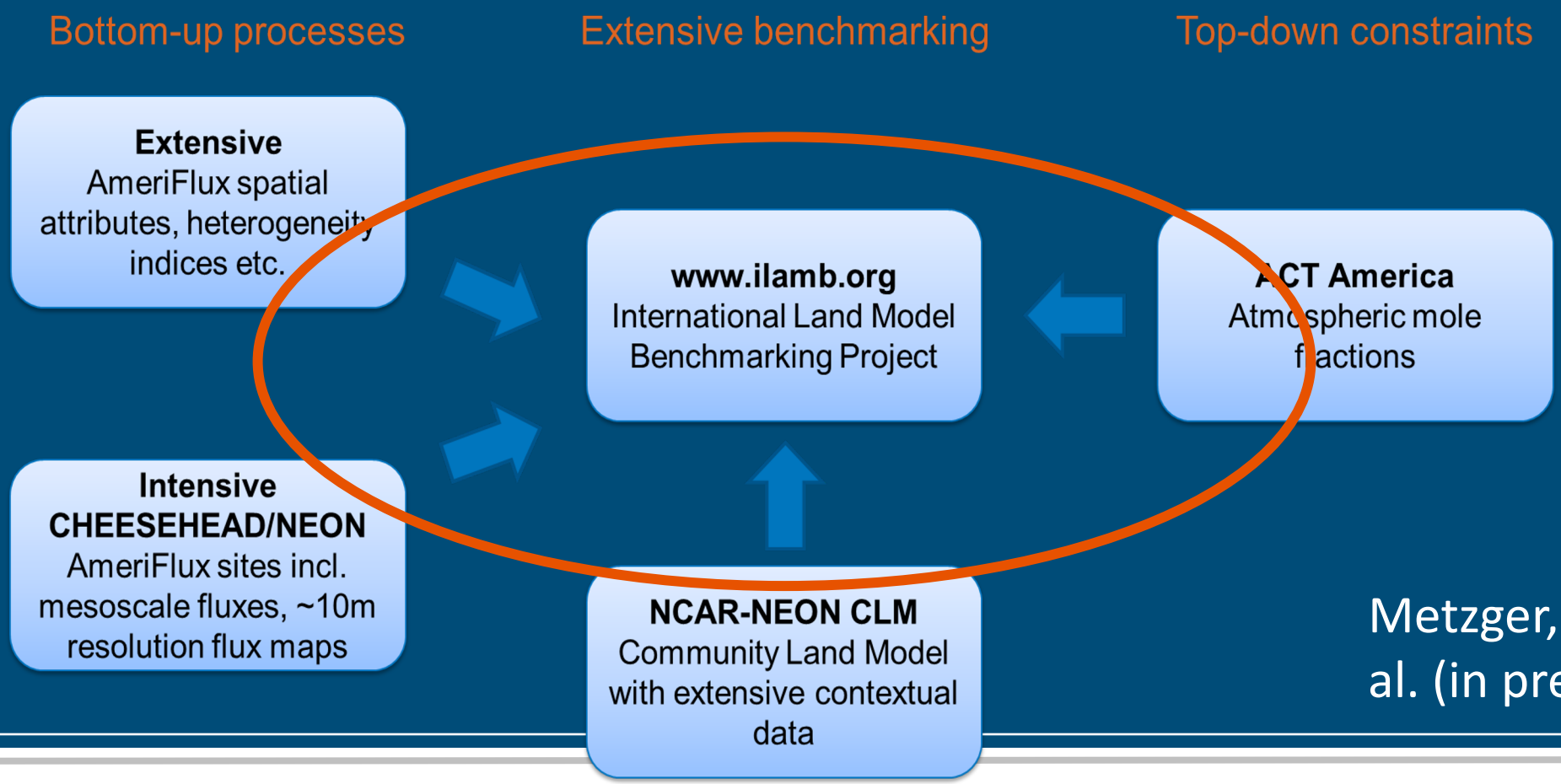


- Five, six-week campaigns over 3 years, covering each season and summer twice. ~25 flights / campaign.
- Each campaign: 2 weeks in each of 3 regions across US (MidAtlantic, MidWest, SouthCentral).
- About 50% of the data in the atmospheric boundary layer (ABL). Fair weather and frontal flight patterns.
- 1140 total flight hours. About 1,500 flasks and 1,000 vertical profiles.

4. Spatial scaling

Scale-aware benchmarking framework

Complement bottom-up process information with top-down constraints.



Metzger, Davis et al. (in prep)

Workshop report and EOS science update:

riley.lbl.gov/rubisco-ameriflux-working-group/

RUBISCO-AmeriFlux Working Group

RUBISCO
REDUCING UNCERTAINTIES IN BIOGEOCHEMICAL INTERACTIONS THROUGH SYNTHESIS AND COMPUTATION

AMERIFLUX

The RUBISCO-AmeriFlux workshop, held on October 15 – 17, 2019, initiated a long-term working group focused on facilitating development, testing, and application of methods to use observations from eddy covariance sites to improve process understanding and land models. The working group, a collaboration between DOE's RUBISCO Scientific Focus Area and the AmeriFlux Management Project, will bring together scientists at multiple levels across a broad range of fields. A novel aspect of the Working Group is an incubator for early career scientists with support for extended visits to Berkeley Lab to develop research projects and leverage facilities and expertise of the RUBISCO and AmeriFlux teams. Expected outcomes include long-term collaborations, follow-on focus groups, and publications.

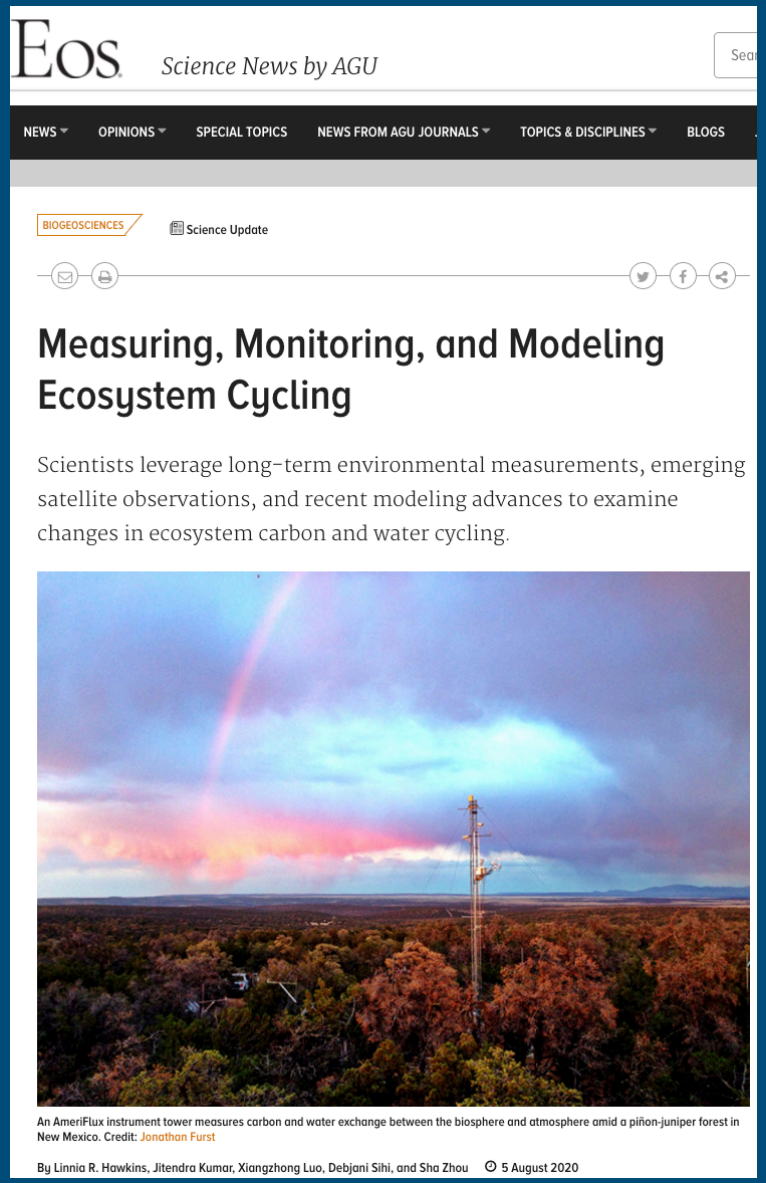
Workshops

Workshop #1 (Oct. 2019)

Workshop #2 (Oct. 2020)

Reports

Measuring, Monitoring, and Modeling Ecosystem Cycling



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BIOGEOSCIENCES Science Update

Measuring, Monitoring, and Modeling Ecosystem Cycling

Scientists leverage long-term environmental measurements, emerging satellite observations, and recent modeling advances to examine changes in ecosystem carbon and water cycling.

An AmeriFlux instrument tower measures carbon and water exchange between the biosphere and atmosphere amid a piñon-juniper forest in New Mexico. Credit: Jonathan Furst

By Linnia R. Hawkins, Jitendra Kumar, Xiangzhong Luo, Debjani Sihi, and Sha Zhou 5 August 2020

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thanks to the 100+ working group participants

Thank you!